In re Appln. of Mami et al.
Application No. 10/563,065
Response to Office Action of January 23, 2008

Amendments to the Drawings

The two (2) attached sheets of drawings include changes to FIG. 1 and new FIG. 2. These sheets, which include FIG. 1 and new FIG. 2, replace the original sheet including FIG. 1. The as-filed written specification fully supports new FIG. 2. Therefore, no new matter is added.

Applicants respectfully request that the replacement drawing and the new drawing be accepted and made of record in the file.

Attachments: Two Sheets of Drawings (FIGS. 1-2)

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REMARKS

The following remarks are responsive to Office Action of January 23, 2008.

At the time of the Office Action claims 1–12 were pending. The Specification stands objected to as having a title that is non-descriptive. The drawings stand objected to as failing to show every feature of the invention specified in the claims. Claims 1–12 stand rejected under 35 U.S.C. §101 as being directed toward non-statutory subject matter. Finally, claims 1–12 stand rejected under 35 U.S.C. §102 as being anticipated by U.S. Patent No. 6,697,778 to Kuhn, et al. (hereinafter Kuhn).

Objections to the Title

1. Applicants have amended the title to be more descriptive and indicative of the invention to which the claims are directed.

In the OA, on p. 2, the Examiner objected to the title as being non descriptive. Applicants therefore have amended the title so that it is more descriptive and indicative of the invention to which the claims are directed. In the event that this objection is maintained, Applicants welcome the Examiner's suggestions as to a title that might be more appropriate.

Objections to the Drawings

2. Applicants have amended the drawings to include the claimed features.

In the OA, on pp. 2–3, the Examiner objected to the drawings as failing to show the claimed features. Applicants have amended the Drawings as follows. Figure 1 has been amended to include descriptive labels in the blocks of the block diagrams, and the reference characters related thereto have been moved. Figure 2 is a flowchart that has been added to illustrate and embodiment of the claimed inventive method, in a general sense. The reference characters pertaining to newly added Figure 2 have been added to the Specification.

The amendments to the drawings do not introduce new matter, and support for the method steps illustrated in the drawings can be found in the appertaining section of the specification to which the associated reference characters have been added.

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Based on the amendments to the Specification and Drawings, Applicants respectfully assert that they have addressed the Examiner's bases for objection and respectfully request that the objections be withdrawn from the application.

35 U.S.C. §101 Claims 1–12 Non-statutory Subject Matter

3. *Applicants have amended independent claims 1, 7, and 12 to include a tangible device in which results are produced from inputs and provided as outputs to a concrete application.*

In the OA, on pp. 3–4, the Examiner rejected claims 1–12 as being directed to non-statutory subject matter. The Examiner stated that these claims merely manipulate an abstract idea (the mathematical manipulation of data (speech information)) without a claimed limitation to produce a useful, concrete and tangible result.

Applicants have therefore amended independent claims 1, 7, and 12 to include a tangible device of the system in which results are produced from inputs and provided as outputs to a concrete application relating to the acoustic vocal signal of the speaker. Concrete examples of such applications are identified in dependent claims 9–11, and therefore claim 1 is a more general statement of such a concrete application. Thus, the addition of these applications meet the requirements for a useful, tangible, and concrete result pursuant to the test laid out in MPEP §2106 (IV)(C)(2).

Support for the implementation of the method and system to include a tangible device can be found in paragraph [0010] of the Specification.

The inclusion of the claimed device renders the invention as a statutory machine for the system claims and as incorporating a machine for the method claim.

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Based on the amendments to the independent claims, Applicants respectfully assert that the Examiner's basis for the non-statutory subject matter rejection have been fully addressed and request that the Examiner withdraw the rejection based on 35 U.S.C. §101.

35 U.S.C. §102(e) Claims 1–12 Anticipation by Kuhn

4. *Applicants have amended independent claims 1, 7, and 12 to clarify the distinction between the E reference speakers and the speaker sets used in Kuhn and provided discussion below for distinguishing the disclosure of Kuhn from the present invention, with claims as amended.*

In the OA, on pp. 4–5, the Examiner rejected claims 1–12 as being anticipated by Kuhn. In the OA, with regard to independent claims 1, 7, and 12, the Examiner stated:

> Kuhn… teaches analyzing vocal signals of a speaker using probability densities between reference signals and in an input signal and analyzing the probability densities (col. 2 lines 1–10; col. 2 lines 41–55; col. 4 line 34 – col. 5 line 10).

Applicants have amended independent claims 1, 7, and 12 to include the limitation that the set of vocal representations of E reference speakers do not include the speaker himself.

Support for the amendment that the E reference speakers do not include the speaker himself can be found in paragraphs [0013]–[0016]. The covariance matrix of the speaker is created with respect to the E reference speakers [0013]. However, since this covariance matrix is independent of the speaker [0015], the speaker himself cannot be one of the E reference speakers or there would be a dependence in the covariance matrix on the speaker.

The E reference speakers provide a common basis for the analysis of the current speaker in comparison to test or other speakers. These E reference speakers are represented by their reference GMM models and will represent the new acoustic representation space ([0044]). The speaker λ to be authenticated, the S test speakers, and the T speakers are

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represented on the same predetermined GMM model ([0045]–[0046]) and are all with reference to the E reference speakers. The system calculates a vector representation of these speakers with respect to these E reference speakers (end of [0046]). The speaker λ is represented by a vector of probability density of the resemblances to the E reference speakers ([0047]).

Then, the speaker identification consists in calculating a measure of likelihood from among the set of S speakers ([0055]).

In Kuhn, the set of training speakers GMM representations is transformed in a set of supervectors, one per speaker (column 2, lines 8–10), then a linear transformation is performed on theses supervectors to obtain a low-dimensional eigenspace (column 2, lines 12–13). Therefore, each eigenvector is a mix of different training speakers for a particular voice parameter and some eigenvectors may be discarded (column 2, lines 15–18). New speech data from a speaker λ is used to construct a supervector that is dimensionally reduced and represented in the eigenspace (column 2, lines 27–29).

Then, in Kuhn, the speaker λ is "recognized" if its reduced supervector is within a threshold proximity to the training data for that client speaker (column 2, lines 32–34). The reduced supervector could be a point or distribution within eigenspace (column 2, lines 32–33).

Comparing the invention and Kuhn, it appears clearly that Kuhn does not disclose or suggest the invention with claims as currently amended.

Indeed, the training data of Kuhn may be understood as equivalent to the set of S speakers of the present invention as both are used to compare the data coming from the searched speaker and includes data related to the speaker himself. Therefore, Kuhn does not disclose the use of the E reference speakers, which are real speakers, from which GMM models are used as same kind of reference coordinates for the other speaker data. Indeed, S

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and T speakers are represented by a vector of the space of resemblances to the predetermined set of the E reference speakers ([0054])—thus there is no equivalent element disclosed by Kuhn to the E reference speakers of the present invention.

If, in another hypothesis, the training data of Kuhn are considered as equivalent to the set of E reference speakers, the set of E reference speakers is not transformed in an eigenspace before any comparison but is used with all the parameters of the GMM model (for instance, equations (4) to (7), [0029]).

A second aspect of the invention differs from Kuhn: the coefficients quantifying the proximity of a voice compared to a set of voices of reference.

Thus, the point of distinction is that in Kuhn, these coefficients are called W_j and are the eigenvalues of the speaker model (column 10, lines 15–25). But, in the invention, it is a likelihood score calculated from the GMM models ([0029]–[0055]). Put another way, in Kuhn, the coordinates are actual characteristics of the speakers themselves (supervectors), whereas in the presently claimed invention, the coordinates reflect resemblances between the speakers and the reference speakers, and not characteristics of the speakers themselves, as in Kuhn.

These differences are significant and are not just a mere adaptation of the model proposed in Kuhn. Indeed, in Kuhn, to reduce the complexity of computing the comparison, the GMM models are transformed into an eigenspace. However, during this transformation, some data are discarded (column 11, lines 20–28) as a necessity to its implementation. Consequently, to enhance the proximity assessment, Kuhn uses some marginal density in the orthogonal complement space (column 11, lines 17–22). Kuhn states:

> Although dimensionality reduction preserves the most important basis vectors, some higher-order information is discarded.

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In sharp contrast to Kuhn, in the invention, all comparisons are based on the GMM models and relate to probability densities representing resemblances between the vocal representation of the speaker and a predetermined set of vocal representations of E reference speakers. This very advantageously permits a significant reduction in computational power, but with no information being lost during the computation. As an additional benefit of the invention, there is no need to add a further step to enhance the proximity assessment, as is required in Kuhn.

The remaining dependent claims in the application are not anticipated by Kuhn by virtue of their dependence from the amended independent claims.

For these reasons, and based upon the amendments to the independent claims, Applicants respectfully assert that the present invention is not anticipated by Kuhn and respectfully request that the Examiner withdraw the rejection under 35 U.S.C. §102.

Conclusion

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

/brian c. rupp/

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